on the problems engaging the plant physiologist and morphologist. Mention should also be made of the wealth of excellent illustrations accompanying the text.—W. MARQUETTE.

The Eusporangiatae

CAMPBELL has published[3] a summary of the present knowledge concerning the morphology of the Ophioglossaceae and the Marattiaceae. His own studies of these forms have extended through twenty years, and his opportunities for observing and collecting tropical material have been unusual, so that such a summary is extremely valuable in bringing together the author's results and conclusions. The chief interest connected with this assemblage of plants is that in all probability it represents in the present flora the very ancient group which gave rise to seed plants. The main thesis of the work, however, is that Ophioglossaceae and Marattiaceae are genetically related, and that species of *Ophioglossum* are to be regarded as the most primitive forms of this assemblage, and in fact the most primitive living vascular plants. There is hardly room for difference of opinion today as to the close relationship that exists between the Ophioglossaceae and the Marattiaceae, and it is time to remove the Ophioglossaceae from their isolation as Ophioglossales, and to associate them with Marattiaceae as eusporangiate Filicales. As to the extremely primitive character of *Ophioglossum* and its relatively direct connection with the bryophytes, there is room for considerable difference of opinion.

The connection of *Ophioglossum* with bryophytes of the *Anthoceros* type is presented fully and skilfully. In embryogeny, the Eusporangiatae are characterized by the late development of the vegetative organs, as contrasted with the leptosporangiates, so that the young sporophyte is much more fully developed before it becomes independent of the gametophyte. In fact, several roots and leaves may be developed before independence, and in some cases even spores are formed before the two generations become completely separate. Moreover, the young sporophytes of *Ophioglossum* and *Anthoceros* resemble one another in appearance, with the massive foot in both cases, and the spore case of the latter represented by the cotyledon of the former. The author sees in this cotyledon, now sterile, a "pro-*Ophioglossum*" with a sporangiferous cotyledon, and with a stemless body, consisting of only leaf and root, the latter feature still being true of *O. moluccanum*. Of course the so-called "imbedded" sex organs of *Anthoceros* have long been recognized as a pteridophyte feature. The sperms of *Anthoceros* and *Ophioglossum* are regarded as perhaps the greatest obstacle, but if pteridophytes have been derived from bryophytes, that obstacle was overcome somewhere, either outside of the group or within it.

In reference to the subterranean gametophyte, which characterizes both

[3] CAMPBELL, D. H., The Eusporangiatae, the comparative morphology of the Ophioglossaceae and Marattiaceae. Carnegie Institution of Washington, Publ. no. 140. pp. vi+229. *pls. 13. figs. 192.* 1911.

Ophioglossum and *Lycopodium*, it is stated that there is "no question" that it is a secondary condition derived from such a gametophyte as that of *Marattia*, and probably through association with the symbiotic fungus. Of course it is known that the green, aerial portion of the gametophyte of certain species of *Lycopodium* is secondary, arising from the previously formed tuberous, subterranean portion, but it is conceivable that the gametophyte of *Ophioglossum* had a different origin. It is interesting to note in this connection, what may be of service to the author's view, that the gametophyte branches of some of the Anthocerotales become tuberous and subterranean, and that this habit is not unusual among liverworts.

In presenting the comparative morphology of Ophioglossaceae and Marattiaceae, the author has used the greatest variety of structures, but the conclusion as to genetic connection seems sound. In some cases the interpretations are at variance with what have come to be conventional; but, in the main, these unconventional interpretations have not so much to do with the relations of Ophioglossaceae and Marattiaceae as with the primitive character of the former among vascular plants. For example, to conclude that a short-necked archegonium is primitive as compared with a long-necked one, and that the collateral vascular strands of *Ophioglossum* are primitive and the concentric ones of the Marattiaceae replace them later, may be true for the reasons given, but it is unconventional. There seems to be no conception of the transition region as the one of vascular origins, and that the vascular systems of stem, root, and cotyledon are related to one another through it. However, since the transition region often appears to be merely a place rather than a definite structure, perhaps we have been laying too much stress upon it.

The general conclusion is that "from some form, allied to the simpler existing species of *Ophioglossum*, the whole fern series is descended"; that in this series "the leaf is the predominant organ, the stem at first being quite subordinate in importance"; that "this ancestral fern was monophyllous and the leaf at first was a sporophyll"; and that "from this central type presumably several lines diverged, of which only a few fragments exist." The details of structure and of lines of divergence are too numerous to cite; but the contribution as a whole is essential to every student of pteridophytes.—J. M. C

Cecidology

Probably the most important general work on cecidology recently published is KÜSTER'S *Die Gallen der Pflanzen*.[4] The author gives a clear and concise statement of the theories and problems which confront the botanist. In the preface he calls attention to the fact that there is no book on the general subject of gall formation, and that the recent literature has demonstrated the necessity of studying both the botanical and zoological phases of the subject. He also

[4] KÜSTER, ERNEST, Die Gallen der Pflanzen, ein lehrbuch für Botaniker und Entomologen. 8vo. pp. 437. *figs. 158*. Leipzig: S. Hirzel. 1911.